PLANT COMMUNITY CHANGES WITHIN A MATURE PINYON-JUNIPER WOODLAND[1]

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ABSTRACT.—Vegetal composition was determined during 1974 and 1984 using 60 permanent 50 m^2 plots within a mature pinyon-juniper community in northeastern Utah. Results indicated that not only was there little significant change in community composition, but with many species frequency and density remained nearly the same during the decade.

Pinyon-juniper woodlands occur on over 325,000 km^2 of the intermountain region and comprise a major habitat for big game on winter ranges. However, forage productivity and variety seldom remain near optimum levels since tree density and canopy cover gradually increase with age, while understory vegetation decreases (West et al. 1979). Grazing by livestock or big game accelerates loss of understory vegetation and ground cover resulting in a further decrease of grazing capacity and increased soil erosion (Baxter 1977). Thus, a need for periodic tree control in pinyon-juniper stands is evident if maximum grazing is an objective. This paper presents data indicating little successional change of a plant community within a mature pinyon-juniper woodland during a 10-year period.

METHODS

In conjunction with other studies (Austin and Urness 1976, Austin et al. 1977), 60 permanent plots were established at the foot of the Blue Mountain Anticline in the Miners Draw area of northeastern Utah in Uintah County. Plots were distributed in the zone dominated by pinyon-juniper between 1,650 and 1,850 m elevation. To insure that plots could be found in subsequent years, plot locations were preselected at specific distances and directions from evident landmarks using topographic maps and aerial photographs. Each plot was rectangular, measured 5.5 x 9.1 m, and was marked by steel reinforcement rods on all corners.

Plots were established and initial data collected during early summer 1974, with data comparably collected in 1984. In sampling, plot boundaries were defined by connecting the four corners with a string. All perennial plants within the plot were counted and recorded by species. To assure that individual plants were not missed on these large plots, a separate search was made for every perennial species, previously identified in the area, on each plot. Each plot was then searched for annual species as a group. Individual species were recorded as present, but individuals were not counted. Also recorded were maximum height and mean crown diameter, measured along the north-south and east-west axes, of juvenile (31–120 cm height) trees of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) and shrubs of low sagebrush (*Artemisia arbuscula*), big sagebrush (*Artemisia tridentata*), and birchleaf mahogany (*Cercocarpus montanus*).

Data were analyzed using the standard and paired t-tests with a significance level of $p \leq .05$.

RESULTS AND DISCUSSION

Few significant changes were found to occur during the 10-year period (Table 1). Only three species, needle and thread (*Stipa comata*), Fendler spring parsley (*Cymopterus fendleri*), and thickstem wild cabbage (*Caulanthus crassicaulis*), showed a significant decrease while only broom snakeweed (*Gutierrezia sarothrae*) showed a significant

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TABLE 1. Number of plants per 60 permanent 50 m^2 plots and frequency of occurrence in ( ).

	1974		1984	
TREES				
Juniperus osteosperma (Torr.)				
mature[1]	272	(59)	271	(59)
juvenile	44	(23)	53	(27)
seedling	39	(25)	42	(26)
Pinus edulis (Engelm.)				
mature	22	(12)	23	(12)
juvenile	13	(5)	11	(7)
seedling	53	(20)	65	(20)
SHRUBS				
Artemisia arbuscula (H. & C.)	154	(14)	185	(12)
Artemisia tridentata (Nutt.)	70	(13)	67	(13)
Atriplex canescens (Pursh)	2	(1)	1	(1)
Atriplex confertifolia (Torr. & Frem)	3	(2)	1	(1)
Cercocarpus montanus (Raf.)	8	(4)	9	(5)
Ephedra nevadensis (S. Wats.)	4	(1)	4	(1)
Ephedra viridis (Coville)	166	(22)	168	(24)
Eriogonum microthecum (Nutt.)	30	(10)	44	(10)
Forsellesia meionandra (Koehne)	2	(1)	2	(1)
Grayia spinosa (Hook.)	2	(1)	1	(1)
Gutierrezia sarothrae (Pursh.)[2,3]	302	(26)	703	(30)
Artemmisia spp. (dead skeletons)	502	(32)	435	(32)
Total (Live shrubs)[2,3]	743	(46)	1185	(51)
GRASSES-PERENNIAL				
Aristida longiseta (Stend.)	23	(3)	24	(3)
Distichlis stricta (Torr.)	42	(1)	63	(1)
Oryzopsis hymenoides (R. & S.)	14	(5)	6	(2)
Poa secunda (Presl.)	92	(23)	111	(26)
Sitanion hystrix (Nutt.)	199	(37)	301	(43)
Stipa comata (Trin. & Rupr.)[2]	4	(4)	1	(1)
Total	374	(49)	506	(50)
GRASSES-ANNUAL				
Bromus tectorum (L.)	—	(22)	—	(53)
Festuca octoflora (Walt.)	—	(4)	—	(7)
Total		(24)		(53)
FORBS-PERENNIAL				
Arenaria fendleri (A. Gray)	9	(2)	4	(1)
Aster arenosus (Blake)	1451	(24)	1502	(24)
Caulanthus crassicaulis (Torr.)[2]	62	(9)	21	(5)
Cryptantha spp.	408	(44)	692	(46)
Cymopterus fendleri (A. Gray)[2]	11	(4)	2	(1)
Echinocactus simpsonii (Engelm.)	22	(4)	34	(2)
Erigeron spp.	5	(4)	8	(2)
Eriogonum ovalifolium (Nutt.)	23	(9)	28	(9)
Erysimum asperum (D.C.)	1033	(48)	782	(53)
Gilia congesta (Hook.)	252	(32)	153	(31)
Hymenoxys richardsonii (Hook.)	37	(3)	32	(3)
Linum lewesii (Pursh)	36	(3)	21	(5)
Lithospermum ruderale (Dougl.)	8	(3)	3	(1)
Lygodesmia grandiflora (Nutt.)	3	(1)	0	(0)
Machaeranthera grindeloides (Nutt.)	91	(13)	120	(16)
Mamillaria tetrancistra (Engelm.)	1	(1)	2	(1)
Opuntia spp. (number of pads)	11679	(50)	10304	(50)
Penstemon spp.	197	(38)	367	(43)
Petradoria pumila (Nutt.)	377	(10)	347	(10)
Phlox hoodii (Richards)	4	(1)	2	(2)
Physaria chambersii (Rollins)	51	(16)	71	(14)
Senecio multilobatus (T. & G.)	46	(6)	23	(7)
Sisymbrium linifolium (Nutt.)	867	(16)	1033	(33)
Townsendia incana (Nutt.)	189	(36)	120	(32)

Table 1 continued.

FORBS-PERENNIAL continued	1974		1984	
Tragopogon dubius (Scop.)[2]	6	(3)	0	(0)
Total	16868	(60)	15671	(60)
FORBS-ANNUAL				
Camelina microcarpa (Angrz.)	—	(1)	—	(5)
Chenopodium spp.	—	(2)	—	(2)
Eriogonum cernuum (Nutt.)	—	(2)	—	(1)
Eriogonum nutans (T. & G.)	—	(3)	—	(2)
Salsola kali (L.)	—	(2)	—	(2)
Streptantella longirostris (S. Wats.)	—	(6)	—	(7)
Others	—	(13)	—	(12)
Total		(25)		(25)

[1]Defined by height: Mature = 121 + cm, Juvenile = 31–120 cm, seedling = 0–30 cm.
[2]Plant numbers significantly different between 1974 and 1984 standard t-test ($p \leq .05$).
[3]Plant numbers significantly different between 1974 and 1984 paired t-test ($p \leq .05$).

increase using the standard t-test. However, because of the small number of plants found, only the broom snakeweed was significant using the paired t-test. These data clearly showed that the plant community exhibited little change during the decade.

The number of mature trees remained the same with a combined density of 980 trees per hectare in both 1974 and 1984 (Table 1). Mean yearly height and crown diameter growth of juvenile Utah juniper were 1.8 and 1.4 cm, respectively, and for pinyon pine 1.2 and 1.0 cm, respectively.

Except for broom snakeweed, numbers of shrubs by species did not change. Dead skeletons of sagebrush (*Artemisia* spp.) were counted to possibly detect a change in density from the community prior to 1974. Although the change in dead sagebrush was also insignificant, it is interesting to note that in 1974 the ratio of dead to live sagebrush was 2.2:1.0 and 1.7:1.0 in 1984. Since numbers of live sagebrush plants showed little change, these data suggest sagebrush was more abundant prior to 1974. Mean yearly height and crown diameter growth for low sagebrush were 0.3 and 1.3 cm, respectively; big sagebrush averaged 0.6 and 1.4 cm, and birchleaf mahogany grew 3.0 and 2.3 cm, respectively. Sagebrush growth was slow but comparable to tree growth, whereas birchleaf mahogany, although found in only a few areas, did somewhat better. The total number of live shrubs showed a significant change mostly because of the increase in broom snakeweed.

Perennial grasses and forbs showed little change (Table 1). With reference to occurrence, 8 perennial species repeated the same frequency, 13 decreased, and 10 increased. The total number of perennial forbs counted did not statistically change. Excluding prickly pear (*Opuntia* spp.), 5,189 and 5,367 forbs were counted in 1974 and 1984, respectively. Even though annual grasses were found on more plots in 1984, annual forbs retained a low level of frequency.

Although this study did not show a changing trend in the understory plant community, many studies have determined an inverse relationship between density or crown cover of trees and understory production (Jameson 1967, Pieper 1977, Tausch and Tueller 1977). Since pinyon and juniper trees are more efficient competitors for soil moisture than understory vegetation, a decrease in the understory is predictable with time (West 1984). Consequently, a constant reduction of understory vegetation can be expected on disturbed sites as soon as a tree species is reestablished.

From the standpoint of big game values on winter range, these data indicate the study site carrying capacity of the mature pinyon-juniper woodland was unchanged over a 10-year period or changing at such a rate as to be statistically undetected. Even though little change in carrying capacity can therefore be predicted, it must be realized that carrying capacity was already low. Austin and Urness (1975) reported a winter deer density on the study area of about .07 deer/ha and believed the population was near carrying capacity. Treatment of the pinyon-juniper stand as previously recommended (Austin and Urness 1975) into small blocks of cleared woodland is needed if increased wildlife and livestock grazing capacities are desirable. Without treatment no change or only slow changes can be predicted in understory vegetation accompanied by increased soil erosion and loss of site productivity potential (West 1984).

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